(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 014 619 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
28.06.2000 Bulletin 2000/26

(51) Int. Cl.[7]: H04L 12/14, H04M 15/00

(21) Application number: 98124376.9

(22) Date of filing: 22.12.1998

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE
Designated Extension States:
AL LT LV MK RO SI

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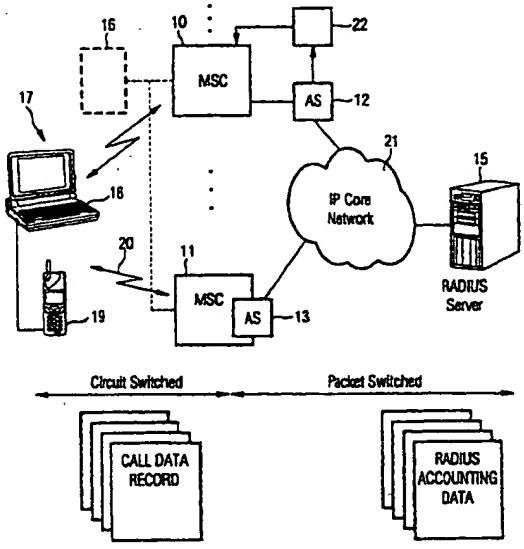
(54) Communication network and method for charging and accounting

(57) The present invention relates to a method and a communication network comprising a packet switched network part and a circuit switched network part and an interface between the packet switched network part and the circuit switched network part, wherein the circuit switched network part produces a call data record assigned to each call initiated and established from the circuit switched network part, said call initiating a session in the packet switched network part via the interface, wherein the packet switched network part generates a session data record assigned to said session and comprising session information being transferred from the packet switched network part to the circuit switched network part via the interface, and, within the circuit switched network part, means for adding the received session information to the call data record assigned to said initiated and established call, and

means for charging and accounting the call on the basis of the call data record and said session information of the call data record.

FIG. 1



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Description

[0001] The present invention relates to charging and accounting in a communication network comprising a first network part and a second network part. The first network part can be a circuit switched and the second network part can be a packet switched network part.

[0002] Currently there is still a clear separation between the charging and accounting in circuit and packet switched worlds. In a circuit switched service or network, for instance, the public telecom network or a mobile telephone network accounting of services or calls is performed on the basis of the duration of the circuit switched and established call connection. In packet switched services or networks like the Internet or the world wide web information packets are sent to the user during a session, for example point-to-point protocol (PPP) or IP (Internet Protocol) session and accounting of the user session or call is performed on the basis of the duration of the session or of the number of information packets or of a flat-rate prize.

[0003] On the circuit switched network side accounting information is collected in a billing center whereas on the packet switched network side charging and accounting is provided by an accounting server, for instance, a remote authentication dial in user service (RADIUS) server, which will be called RADIUS in the following. Consequently, the user receives a bill issued by the billing center of the circuit switched network and a further bill issued on the basis of the session data collected in the accounting server or RADIUS server of the packet switched service. In the case the user wants to check the bills, it is awkward and difficult for the user to find corresponding lines or statements in both of the bills with regard to the same call or session.

[0004] Therefore, it is an object of the present invention to attain an improved transparency in charging and accounting in a communication network having a first network part and a second network part.

[0005] This object is solved by the communication network of claim 1 and by the method of claim 20.

[0006] Accordingly, the communication network of the invention comprises a first network part and a second network part and an interface between the first network part and the second network part, wherein the first network part produces a call data record assigned to each call initiated and established from the first network part, said call initiating a session in the second network part via the interface,

wherein the second network part generates a session data record assigned to said session and comprising session information being transferred from the second network part to the first network part via the interface, and, within the first network part, means for adding the received session information to the call data record assigned to said initiated and established call, and means for charging and accounting the call on the basis of the call data record and said session information of the call data record.

[0007] In the communication network and the method of the present invention session information or a session identifier is sent from the second network pan to the first network part, where the session information is added to the corresponding call data record. Charging and accounting of calls is carried out on call data records, for instance, in a billing center. Advantageously, each call data record comprises in addition the session information or session identifier, for instance, the Session_Id of the second network part. This means, that the call data records on the first network side now also comprises correlation information or accounting information from the second network side which allows correlation of accounting on both sides or the issue of one bill comprising accounting data of the first network part and the second network part in one bill. The present invention, therefore, improves transparency of accounting and service to the user of the communication network.

[0008] The first and second network parts can be circuit and packet switched network parts, or can both be packet switched or circuit switched network parts.

[0009] According to the invention, the circuit switched network part can produce call information within the call data record of said call, the call information being transferred from the circuit switched network part to the packet switched network part via the interface, and, within the packet switched network part, means for adding the received call information to the session data record assigned to said session. This is a further improvement of transparency in accounting since the accounting data records on both the circuit switched side and the packet switched side have the same information for correlation and identification information on the corresponding call.

[0010] Thus, in an preferred embodiment of the invention, a mobile services switching center (MSC) generates a network call reference as call information being part of the call data record, the network call reference is transferred via the interface from the MSC to the RADIUS server or accounting server of the packet switched network part via the access server, and the RADIUS server or accounting server uses the network call reference as session information or session identifier.

[0011] The circuit switched network part of the communication network can be a public land mobile network (PLMN), for instance, a Global System for mobile Communication (GSM) or any other cellular telephone system, an ISDN network, or a public switched telephone network (PSTN). The packet switched network part of the communication network can be, for instance a GPRS (General packet radio system), the Internet or an Internet protocol based network.

[0012] The interface between the circuit switched network part and the packet switched network part of the inventive communication system can comprise, for

instance, an access server or several access servers, a standalone access server in combination with an external interface providing a connecting line for sending the session information or the session identifier from the standalone access server to the circuit switched side, for instance, to a mobile services switching center (MSC) via the external interface, the MSC containing an integrated access server or several integrated access servers. In the case of an integrated access server, an internal interface is provided for transferring the session information or session identifier from the packet switched network part to the circuit switched network part via the internal interface.

[0013] In the method of the invention for charging and accounting a call in a communication network comprising a first network part and a second network part and an interface between the first network part and the second network part, during initiating and establishing a call and during the ongoing call in the first network part, a session is initiated by the call in the second network part, a call data record assigned to said initiated and established call is generated in the first network part, wherein, in the second network part, a session data record is generated which is assigned to the session and comprises session information, wherein the session information is transferred from the second network part to the first network part via the interface, and, within the first network part, the received session information is added to the call data record assigned to said initiated and established call, wherein charging and accounting the call is carried out on the basis of the call data record and said session information added to the call data record.

[0014] Initialization can alternatively be started in the second network and the call can be established to the first network.

[0015] During initiating and establishing a call, a network call reference as part of the call data record can be generated within the first network part, wherein the network call reference is transferred from the first network part to the second network part via the interface.

[0016] During initiating and establishing a call a PPP session in the second network part can be started and authentication and authorization can be proved within the second network part.

[0017] During the PPP session, an Accounting Request message can be sent from the access server (AS) to the RADIUS server or accounting server, the Accounting Request message comprising the call information or a network call reference, afterwards storing the call information or network call reference in the RADIUS or accounting server and in the generated call data record in the MSC, and sending back an Account Response message from the Radius server or accounting server to the MSC. Correlation of the circuit-switched call data records with the RADIUS accounting records is obtained.

[0018] Optionally the network call reference may be used as the Session_Id.

[0019] In a preferred method of the invention the call is able to enter a semi-connected mode, wherein the physical connection is released, whereas the connecting parameters of the dial up session (e.g. PPP or IP) are kept. With this approach a correlation of all the call data records corresponding to different circuit switched call sessions, but to the same user session, for instance, PPP session is achieved. Further, information from the circuit-switched call data records about the duration of the semi-connected mode is available.

[0020] In the semi-connected modus the call re-establishment in the same MSC/access server configuration can be carried out with the following steps:

during initiating and re-establishing the call a further network call reference is generated in the GSM network,

during re-establishing of the session or PPP session the connected access server determines that a session or PPP session has been set up before for the corresponding call or number,

afterwards, the corresponding session information or session identifier stored before in the access server or the accounting server is fetched by the access server and stored in the further call data reference of the MSC.

[0021] In the semi-connected mode the call re-establishment in another MSC/access server configuration is carried out with the following steps:

during initiating and establishing the call a further or new network call reference or call information is generated in the GSM network or the connected MSC,

during re-establishing of the session or PPP session the connected access server requests authorisation and authentication from the RADIUS server or accounting server,

then, the RADIUS server or accounting server determines that the call or number already has another PPP session ongoing in another access server, wherein the session information or session identifier is assigned to the another ongoing PPP session, then the RADIUS server forwards the session information or session identifier to the connected access server, wherein the received session information or session identifier from the RADIUS server or accounting server is stored in the corresponding further network call reference. These features implement a secure operation of the semi-connected mode in, for instance, a GSM/Internet network configuration where roaming of the mobile station or mobile telephone could happen.

[0022] At call disconnection or during the ongoing call, the call data record with the session information or session identifier of the MSC can be sent to a billing center for further charging and accounting processing.

[0023] In a preferred embodiment of the invention, after an access server has sent a session information or session identifier to a MSC, the MSC returns semi-connected mode parameters to the access server. The SCM (semi-connected mode) parameters from the

MSC comprise information about whether SCM is allowed or not or even rejected. This feature helps to run the network in a secure mode if the network operates at its limit of capacity.

[0024] The MSC operation can thereby control the operations done in the access server, e.g. if the access server is owned by an Internet service provider.

[0025] In case of RADIUS accounting issued for the packet switched accounting, the Session_Id may be used as session information to be sent to the circuit switched network part. But different information or different parameters can although be transferred to the call data record, for instance, if other or new protocols like the so called DIAMETER protocol and so on are used. The DIAMETER protocol is thought to be a replacement or enhancement to RADIUS. Further, the session information can comprise a more specified accounting information or a complete accounting information from the accounting server or RADIUS server. In the semi-connected mode, this has the advantage, that correlation of all the call data records corresponding to different circuit switched call session, but to the same user session or PPP session is achieved.

[0026] Further advantageous improvements of the present invention are mentioned in the dependent claims. Further objects, advantages, advantageous improvements and applications of the invention are given in the following description of a preferred embodiment of the invention in connection with the enclosed figures in which:

Fig. 1 is a schematic block diagram of a communication network according to an embodiment of the communication network of the invention having a GSM-network as circuit switched network part and an Internet protocol network as packet switched network part; and

Fig. 2 a signalling flow example of the communication network of figure 1.

[0027] In the following a preferred embodiment of the invention is described and explained by example in connection with the figures 1 and 2. In figure 1 a basic configuration of the preferred embodiment of the communication network of the present invention is shown, wherein a GSM network as circuit switched network part is coupled to an Internet or Internet protocol network as packet switched network part and different states of coupling by an interface between the GSM network and the Internet are illustrated.

[0028] The GSM (Global System for Mobile communication) comprises a mobile station 17 carried by a subscriber, several mobile service switching centres (MSC) 10, 11 that perform the switching of calls between the mobile station 17 and other fixed or mobile network users as well as the management of mobile services and a billing center 16.

[0029] The mobile station 17 comprises the physical equipment, such as the radio transceiver display and digital signal processor and a smart card called the subscriber identified module. In the figure 1 the mobile station 17 comprises a personal computer or a notebook 18 connected via a PCMCIA (Personal Computer Memory Card Industry Association) interface to a mobile telephone 19. The connection between the mobile station 17 and an MSC 10, 11 is performed by at least one base station subsystem (not explicitly shown, but symbolises via the arrow) 20 that communicates with the MSC. The mobile station 17 and the base station sub system 20 communicate across the Um interface, also known as the air interface or radio link. Each MSC 10, 11 acts like a normal switching note of the public switching telephone network or the ISDN and in addition it provides on the functionality needed to handle a mobile subscriber using the mobile station 17, such as registration, authentication, location updating, handovers and call routing to a roaming subscriber. The MSC 10, 11 provides the connection to the Internet or internet protocol core network 21 on the side of the packet switched network part.

[0030] In each of the MSCs 10, 11 in the GSM network, for instance, the following charging and accounting related information is collected in a call data record: calling party number, called party number, time for start of charge, time for stop of charge, tariff class, network call reference, etc..

[0031] More detailed, the MSC 10 is coupled to a standalone access server 12 as interface between the circuit switched GSM network and the packet switched network. The standalone access server 12 provides connection to the Internet. Further the interface comprises an external interface 22 for transferring information or specific information from the standalone access server 12 to the MSC 10.

[0032] The MSC 11 is combined with an access server 13 to the Internet core network 21 wherein this combination of the MSC 11 and the access server 13 provides an integrated access server for interfacing the GSM network to the Internet. Further in the integrated access server an internal interface (not shown) is integrated.

[0033] A remote authentication dial in user service (RADIUS) server 15 is connected to the Internet protocol core network 21. The RADIUS server 15 operates functions or a protocol for carrying out authentication, authorisation and accounting information if requested by one of the access servers 12, 13. For instance the RADIUS server 15 collects the following accounting information or session record data: called station identifier, calling station identifier, service type, user name, user IP address, session-time, input-packets, output-packets, terminate-calls Session_Id, etc. More details of the general functionality of the RADIUS server 15 are mentioned in the reference RFC 2138, April 1997, titled "Remote Authentication Dial in User Service (RADIUS)"

and in the reference RFC 2139, April 1997, titled "RADIUS Accounting".

[0034] The shown communication network has the ability to operate and run in a semi-connected mode (SCM). If a call goes into the semi-connected mode, this means that the physical connection in the GSM network is released, whereas the established PPP session and parameters in the Internet is kept.

[0035] In the following, the signalling flow example shown in the figure 2 is described for detailed explanation of the method of the invention. If the user or subscriber of the mobile station 17 operates the notebook 18 in order to output a call via the mobile telephone 19, the base station subsystem 20 of the GSM network connects the call to the mobile services switching center MSC 10 (MSC-1). After the call connection between the mobile station 17 and the MSC 10 is established, the MSC 10 generates a call data record assigned to the call and sets up the connection to the standalone access server 12 (AS-1) or access server as interface connecting the Internet network as packet switched network part to the GSM network as circuit switched network part of the communication network. The through connection of the call to the access server 12 is shown by reference numeral 1 in the figure 2.

[0036] Next, setting up the PPP session is described which is shown by the arrows of numeral 2 in figure 2. The access server 12 sends an Access Request message from the access server 12 to the RADIUS server 15. After receiving the Access Request message from the access server 12 the RADIUS server 15 outputs an Access Accept message to the access server 12. The RADIUS server 15 then performs authentication and authorisation of the subscriber call by means of information and data exchange between the access server 12 and the RADIUS server 15. If authentication and authorisation is confirmed by the RADIUS server 15 the requested and corresponding PPP (point-to-point protocol) connection or session within the Internet is established.

[0037] In the next step shown by the arrows of numeral 3 in the figure 2, the access server 12 sends an Accounting Request message to the RADIUS server 15 or accounting server. The RADIUS server 15 then generates a session identifier or Session_Id as session information of its session data record or RADIUS accounting data which is assigned to the established PPP session. The generated session identifier is stored in the session data record in the RADIUS server accounting function. Afterwards the RADIUS server outputs an Accounting_Response message that contains the session identifier and is forwarded to the access server 12

[0038] The session identifier is then forwarded by the access server 12 to the MSC 10 via the switched through connection between the access server 12 and the MSC 10 or via the external interface 22. The MSC 10 adds the received session identifier from the access server 12 to the corresponding call data record.

[0039] In an alternative embodiment, during GSM call set up signalling in numeral 1 of figure 2, the MSC 10 generates the call data record assigned to the current subscriber call and a network call reference as call information in the call data record. During the procedure of numeral 1 the MSC 10 forwards the network call reference to the access server AS 12, where the network call reference from the MSC 10 is stored.

[0040] Thereafter the signalling of numeral 3 is initiated by sending the Accounting Request massage from the access server 12 to the RADIUS server 15, wherein the access server 12 adds the network call reference from the MSC 10 to the Accounting Request message. After receiving the Accounting Request message comprising the network call reference the RADIUS server 15 stores this network call reference as session identifier or Session_Id in its session data record. Afterwards the RADIUS server sends the Accounting_Response message having the session identifier to the access server 12 that outputs this session identifier to the MSC 10 as session identifier that is stored in the respective call data record by the MSC 10. Thus, the session identifier from the RADIUS server 15 can be a copy of the network call reference as call information from the MSC 10.

[0041] The network call reference of the call data record is either received by the MSC 10 from another MSC that is connected to the MSC 10, but not to the access server 12, and that has generated the network call reference or the network call reference is generated by the MSC 10 itself, if it did not receive a network call reference as call information.

[0042] After call disconnection, for example after release of the GSM physical connection or also during the ongoing call, the call data record comprising the session identifier assigned to the call is sent to the billing center 16, for instance, via a billing gate way as charging and accounting information with regard to the call. In the billing center 16 the post processing after the call takes place wherein on the basis of the call data record with session identifier accounting and charging is performed. This step is shown by arrow 5 in the figure 2.

[0043] If the MSC 10 and the access server 12 would be combined, i.e. in the case of an integrated access server, the access server 12 would send the session identifier or session information via an internal interface to the MSC 10, wherein the internal interface is integrated into the integrated access server. If the access server 12 is a standalone access server the session identifier or session information from the RADIUS server 15 is sent via external interface 22 to the MSC 10.

[0044] In the following the procedures are described when the call goes into a semi-connected mode that is supported by the shown embodiment of the communication network of the invention. Semi-connected mode indicates generally a technique where it is possible to disconnect the physical layer while the one

or more upper layers stay in a "connect" state. This means, that several circuit switched call sessions with corresponding call data records belong to one semi-connected mode session. Further, the call going into the semi-connected mode means that the physical connection in the GSM network part is released, whereas the PPP session and parameters in the Internet are kept.

[0045] During the semi-connected mode status the mobile station or mobile subscriber may either stay within the covered area of the same MSC and access server (no. 4a in figure 2) or roam to the coverage area of another MSC with the same access server (no. 4c in figure 2) or to another MSC with another access server (no. 4b in figure 2).

[0046] In the following the call re-establishment in the same MSC/AS combination is described. This case is illustrated in figure 2 by number 4a. A call re-establishment in the same MSC 10 and access server 12 is substantially performed like the initial call establishment described above and illustrated with number 1 in figure 2. Since the MSC 10 does not know about the ongoing Internet session and the ongoing RADIUS accounting session, the MSC 10 generates during call re-establishment in the semi-connected mode a further or new network call reference in its call data record. And after through connection, again a PPP session in the Internet is started and initiated. During initiating the establishment of the PPP session the access server 12 determines that it already has set up a PPP session for the corresponding call or a number before. In this case the access server 12 fetches the session identifier or Session_Id stored before in the access server 12 and transfers the found session identifier to the MSC 10 where the session identifier is added to and stored in the call data record.

[0047] The session identifier is sent from the access server 12 to the MSC 10 via, for instance, an external interface 22, since in the shown case the AS 12 is a standalone access server. Further the session identifier may optionally be used as the network call reference in the call data record of the MSC 10.

[0048] Next the call re-establishment in another MSC and another access server is explained in connection with no. 4b in the figure 2.

[0049] In this case a call re-establishment in another MSC/AS combination, for instance, the MSC 11 (MSC-2) and the access server 13 (AS-2) is again substantially performed like the initial call establishment mentioned above with regard to no. 1 in figure 2. In this case, since a roaming into the different coverage area of the MSC 11 by the telephone mobile station subscriber took place, here the MSC 11 generates a separate call data record having a new network call reference because the MSC 11 does not have any information about the pending semi-connected mode state of the PPP session in the old MSC. The MSC 11 therefore initiates after through connection to the access server 13 a PPP session within the Internet. Since the different access server 13 cannot find any information about an ongoing session of the same subscriber in the semi-connected mode, since this is only stored in the access server 12, the access server 13 sends an Access Request message to the RADIUS server 15 and receives the Access Accept message from the RADIUS server 15 in response. Then, during the establishment of the PPP session, the access server 13 requests as described above with regard to no. 2 of figure 2 an authorisation and authentication from the RADIUS server 15. The RADIUS server 15 then determines whether the subscriber of the currently initiated session, for instance, based on a calling party number, already has another PPP session ongoing in the semi-connected mode in another access server. In this case the RADIUS server 15 finds that for the same subscriber or mobile station 17 already a PPP session is ongoing in the semi-connected mode in connection with the access server 12. As mentioned above with regard to no. 3 in figure 2 the RADIUS server 15 determines the RADIUS parameters including the session identifier that, for instance, can be the same session identifier as already used during the ongoing session between the RADIUS server 15 and the access server 12. The session identifier or Session_Id then is forwarded, for instance, within the Accounting_Response message from the RADIUS server 15 to the access server 13. After reception of the session identifier from the RADIUS server 15 the access server 13 transfers or outputs the session identifier to the MSC 11 via, for instance, an internal interface. The MSC 11 then stores the received session identifier in the call data record or uses it optionally as network call reference. The corresponding call data record and the session identifier or Session_Id then are sent to the billing centre 16 via the connection 6 shown in figure 2.

[0050] If after roaming of the mobile station 17 the mobile station 17 enters the covered area of another MSC, but the same access server is maintained, the procedure during re-establishment of the call connection is substantially the same as mentioned above with regard to the case with same MSC and same access server shown by number 4a in figure 2.

[0051] As illustrated by number 4c in figure 2 the new MSC is the MSC 11 and the maintained access server is access server AS 12 as during originally establishing the call and session.

[0052] Again, the MSC 11 of the GSM network generates a call data record with a corresponding, further or different network call reference since the MSC-11 does not know anything about an already ongoing PPP session in the semi-connected mode. The MSC 11 initiates and starts a PPP session in the access server AS 12. The access server AS 12 then determines whether it has already stored a session information or a session identifier for the corresponding calling party number or subscriber before. If the AS 12 finds a session information or a session identifier assigned to the same sub-

scriber as before - which is the case in the example - the found session identifier is output to the MSC 11 that stores this session identifier in its call data record and sends its call data record and the session identifier to the billing centre 16 via the connection 6 for accounting/charging post processing.

[0053] If during re-establishment of the call the access server or the RADIUS server cannot find a corresponding already ongoing session in the semi-connected mode the procedures or steps according to no. 2 and 3 have to be completely performed as during normal establishing of a session.

[0054] Since the mobile station, for instance, in a car can pass or touch the coverage area of several different MSCs, the just mentioned re-establishment procedures can be performed several times in the semi-connected mode.

[0055] After an access server has sent the session information or session identifier to the MSC, the MSC may return semi-connected mode parameters, for instance, whether semi-connected mode is allowed to be used or not or the timer values etc. to the access server. Also the MSC may return a semi-connected mode rejected message in the case semi-connected mode is not allowed for instance due to capacity reasons. Then the access server is instructed not to go into the semi-connected mode but rather release the call or session completely.

Claims

1. Communication network comprising a first and a second network part and an interface between the two network parts, wherein the first and second network parts are based on different accounting systems, and
   wherein the first network part produces a call data record assigned to each call initiated and established from the first network part, said call initiating a session in the second network part via the interface,
   wherein the second network part generates a session data record assigned to said session and comprising session information being transferred from the second network part to the first network part via the interface, and,
   within the first network part, means for adding the received session information to the call data record assigned to said initiated and established call, and
   means for charging and accounting the call on the basis of the call data record an said session information of the call data record.

2. Communication network system according to claim 1, wherein the first network part is a circuit switched network part, and the second network part is a packet switched network part.

3. Communication network according to claim 1, wherein the first and second network parts are packet switched network parts.

4. Communication network according to claim 1, wherein the first and second network parts are circuit switched network parts.

5. Communication network according to one of claims 2 and 4, wherein the circuit switched network part is a public land mobile network PLMN (GSM (Global system of mobile Communication)) or fixed network (PSTN (public switched telephone network) or ISDN).

6. Communication network according to one of claims 2 and 3, wherein the packet switched network part is a GPRS (General Packet Radio System) or Internet or Internet protocol based network.

7. Communication network of claim 2, wherein the circuit switched network part produces call information within the call data record of said call, the call information being transferred from the circuit switched network part to the packet switched network part via the interface, and,
   within the packet switched network part, means for adding the received call information to the session data record assigned to said session.

8. Communication network of claim 2 or claim 7, wherein the packet switched network part comprises a remote authentication dial in user service (RADIUS) server or a DIAMETER server producing the session information.

9. Communication network of claim 8, wherein the RADIUS server or the DIAMETER server is the means for adding the call information from the circuit switched network part to the session data record.

10. Communication network of one of the claims 2 to 9, wherein the session information corresponds to a session identifier.

11. Communication network of claim 5, wherein the GSM network comprises one or more mobile services switching centers (MSC), at least one of the mobile services switching centers MSCs generating the call information assigned to said initiated and established call.

12. Communication network of claim 11, wherein each of the mobile services switching centers MSCs is connected to a billing center as means for charging and accounting the respective call.

13. Communication network of one of the claims 1 to 12, wherein the interface between the first and second network comprises an access server or several access servers.

14. Communication network of claim 13, wherein the access server is a standalone access server.

15. Communication of claim 14, wherein in the case of a standalone access server an external interface is provided for sending the session information or the session identifier from the standalone access server to the MSC via an external interface.

16. Communication network of claim 13, wherein the interface comprises an integrated access server or several integrated access servers, each integrated access server being a part of an MSC.

17. Communication network of claim 16, wherein in the case of an integrated access server an internal interface is provided for transferring the session information or session identifier from the packet switched network part to the circuit switched network part via the internal interface.

18. Communication network of one of the claims 1 to 17, wherein the circuit switched network part comprises one or more mobile services switching centers MSCs, at least one of the mobile services switching centers MSCs being coupled to an access server of the packet switched network part.

19. Communication network of claim 18, wherein the mobile services switching center MSC generates a network call reference as call information being part of the call data record, the network call reference being transferred via the interface from the mobile services switching center MCS to the RADIUS server or accounting server of the packet switched network part via the access server, and the RADIUS server or accounting server using the network call reference as session information or session identifier.

20. Method for charging and accounting a call in a communication network comprising a first network part and a second network part and an interface between the first network part and the second network part,
wherein, during initiating and establishing a call in the first network part a session is initiated by the call in the second network part, a call data record assigned to said initiated and established call being generated in the first network part,
wherein, in the second network part, a session data record is generated which is assigned to the session and comprises session information,
wherein the session information is transferred from the second network part to the first network part via the interface, and ,
within the first network part, the received session information is added to the call data record assigned to said initiated and established call, wherein charging and accounting of the call is carried out on the basis of the call data record and said session information added to the call data record.

21. Method according to claim 20, wherein the first network part is a circuit switched network part and second network pan is a packet switched network part.

22. Method of claim 21, wherein during initiating and establishing a call a network call reference as part of the call data record is generated within the circuit switched network part, wherein the network call reference is transferred from the circuit switched network part to the packet switched network pan via the interface.

23. Method of claim 21, wherein during initiating and establishing a call a network call reference as part of the call data record is generated within the packet switched network part, wherein the network call reference is transferred from the packet switched network part to the circuit switched network part via the interface.

24. Method of one of claim 20 to 23, wherein during initiating and establishing a call a Point-to-Point Protocol PPP session in the packet switched network part is started.

25. Method of one of the claims 20 to 24, wherein during initiating and establishing of a call authentication and authorization is proved within the packet switched network part.

26. Method of claim 20 to 25 , wherein during initializing and establishing a call in the GSM network the network call reference of the call data record assigned to said call is generated by an mobile services switching center MSC of the GSM network, said call being coupled to an access server by said mobile services switching center MSC and after through connection a PPP session in the packet switched network part is started.

27. Method of claim 26, during starting of the PPP session an Access Request message is sent from the access server to a RADIUS server and after receiving an Access Accept message from the RADIUS server in the access server the corresponding PPP session or connection is established.

28. Method of claim 27, wherein, during the PPP ses-

sion, an Accounting Request message is sent from the access server (AS) to the RADIUS server or accounting server, the Accounting Request message comprising the call information or a network call reference, afterwards storing the call information or network call reference in the RADIUS or accounting server and in the generated call data record in the mobile services switching center MSC, and sending back an Account Response message from the RADIUS server or accounting server to the MSC.

29. Method of claim 26, wherein the call is able to enter semi-connected mode, wherein the physical connection is released, whereas Point-to-Point Protocol PPP parameters of the dial up session are kept.

30. Method of claim 29, wherein in the semi-connected mode the call re-establishment in the same MSC/access server configuration is carried out with the following steps:
during initiating and re-establishing the call a further network call reference is generated in the GSM network or the connected mobile services switching center MSC,
during re-establishing of the session or PPP session the connected access server determines that a session or PPP session has been set up before for the corresponding call or number,
afterwards, the corresponding session information or session identifier stored before in the access server or the accounting server is fetched by the access server and stored in the further call data reference of the mobile services switching center MSC.

31. Method of claim 29, wherein in the semi-connected modus the call re-establishment in another MSC/access server configuration is carried out with the following steps:
during initiating and establishing the call a further network call reference or call information is generated in the GSM network or the connected mobile services switching center MSC, during re-establishing of the session or PPP session the connected access server requests authorisation/authentication from the RADIUS server or accounting server , then, the RADIUS server or accounting server determines that the call or number already has another PPP session ongoing in another access server, wherein the session information or session identifier is assigned to the another ongoing PPP session,
then the RADIUS server forwards the session information or session identifier to the connected access server;
the received session information or session identifier from the RADIUS server or accounting server is stored in the corresponding further network call reference.

32. Method of one of the claims 19 to 31, wherein at call disconnection or during the ongoing call, the call data record with the session information or session identifier of the mobile services switching center MSC are sent to a billing center for further charging and accounting processing.

33. Method of one of the claims 19 to 32, wherein after an access server has sent a session information or session identifier to a mobile services switching center MSC, the mobile services switching center MSC returns mode parameters to the access server.

34. Method of claim 33, wherein the parameters from the mobile services switching center MSC comprise information about whether semi-connected mode SCM is allowed or not.

FIG. 1

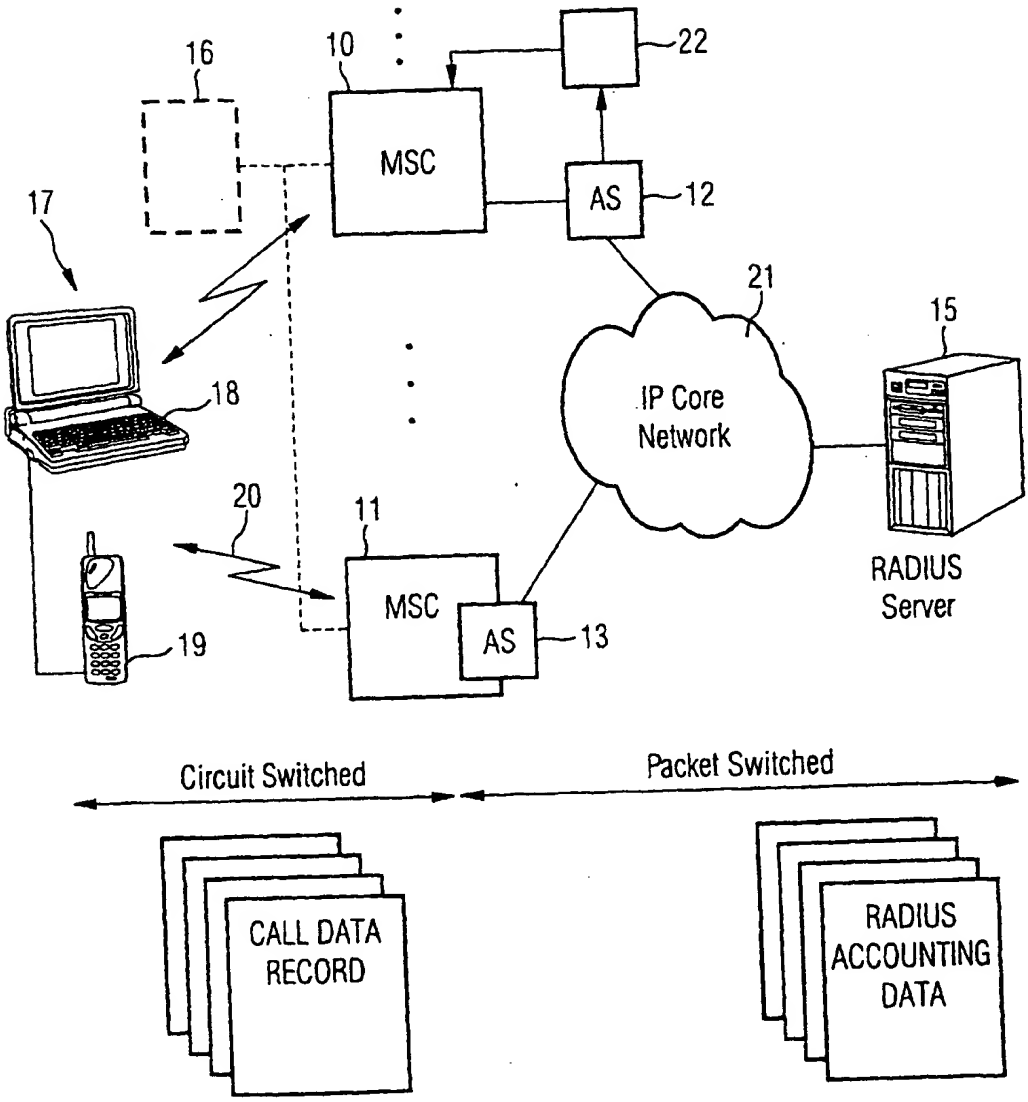
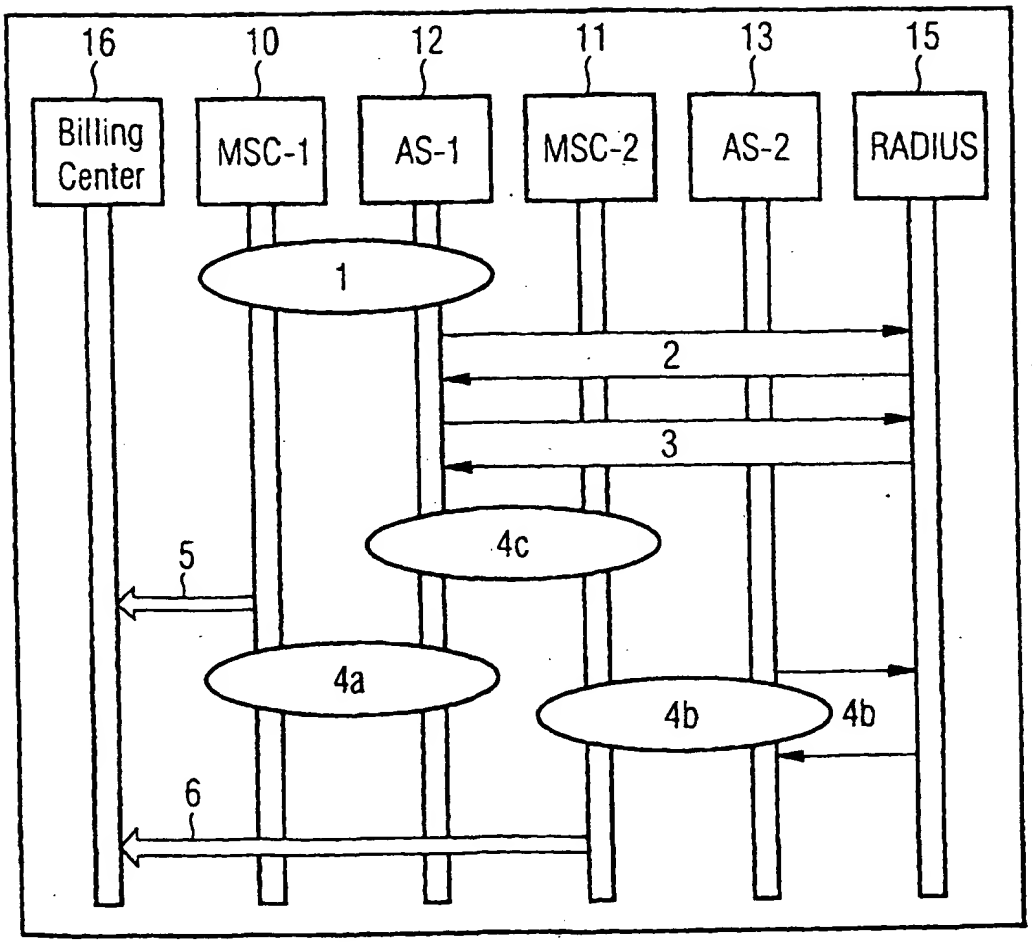

16
10
22
MSC
AS
12
17
21
15
IP Core
Network
18
20
11
MSC
AS
13
RADIUS
Server
19
Circuit Switched
Packet Switched
CALL DATA
RECORD
RADIUS
ACCOUNTING
DATA

FIG. 2


16
10
12
11
13
15
Billing Center
MSC-1
AS-1
MSC-2
AS-2
RADIUS
1
2
3
4c
5
4a
4b
4b
6

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 98 12 4376

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H04M

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	14 July 1999	Ströbeck, A

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